DESIGN BLIMP ROBOT BASED ON EMBEDDED SYSTEM AND SOFTWARE

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Outline

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2 Configuration
   • Hardware Configuration
   • Software Configuration
   • Ground Control Center (GCC)

3 Fuzzy Controlling
   • Modules

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Introduction

The Unmanned Airship Vehicle (UAV) has a massive ability for low altitude and low speed exploration and surveillance applications. In order to develop a blimp based on a small size, light weight, high level functionality and communications, the navigation system and autonomous embedded blimp system are presented here. The low-weight components of a Gumstix computer-on-module running embedded Linux system were described. The interface between onboard Linux operating system and device drivers makes the blimp more applicable and increase the efficiency of exploration to meet the actual needs. The main challenges of designing such a low weight blimp in regard to autonomous operation are the efficient interaction between the software and hardware components and also the efficient of the controller algorithm to improve the behaviors of the blimp.
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Hardware Configuration

- The Main Unit (MU)
Hardware Configuration

- The Main Unit (MU)
- Summit Gumstix Expansion Board
Hardware Configuration

- The Main Unit (MU)
- Summit Gumstix Expansion Board
- Inertial Measurement Unit (IMU)
Hardware Configuration

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- Motors and motor drivers
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- Inertial Measurement Unit (IMU)
- Motors and motor drivers
- Sensors
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2C is a common peripheral bus for embedded systems. As a consequence, it is the easy way to communicate between the Gumstix (master) and Atmega328 (slave).

The Atmega generates the pulse width module (PWM) to control the motors.

Gumstix client will send the flight data to the Ground Control Center and receive commands.
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The GCC is divided into two different milestones.

- The communications protocol between multiple aerial-ground robots
- GUI: interface was used to receive all flight data acquired onboard and supervised explicitly and to define the control parameters

The function that displays the video of the exploration area was added to GCC.
Sub-Controllers
The first and second sub-controllers are using the fuzzy sets to find the shortest distance between the blimp and the obstacles in the horizontal path. The third sub-controllers could find the shortest altitude during the flight.

Avoidance of obstacles controller
to keep the blimp at a safe distance from frontal obstacles. The collision avoidance system should cause the blimp to change the direction of main propellers motors (the vectorization angle) when the front sensors detect an obstacle in a certain distance.

Altitude Controller
The change in altitude error indicates whether the blimp is approaching the reference altitude or moving away from altitude.
we presented a powerful, low-weight, and embedded system which is applicable for autonomous blimp robot. We designed an embedded hardware and software system on the blimp.
For Further Reading

T. Xu, X. Zhang, and Y. Lu  
*onboard controlling system design of unmanned airship.*  

A. Elfes, A. Bueno, and M. Bergerman  
Robotic airships for exploration of planetary bodies with an atmosphere: autonomy challenges.  